SKIN DIVER

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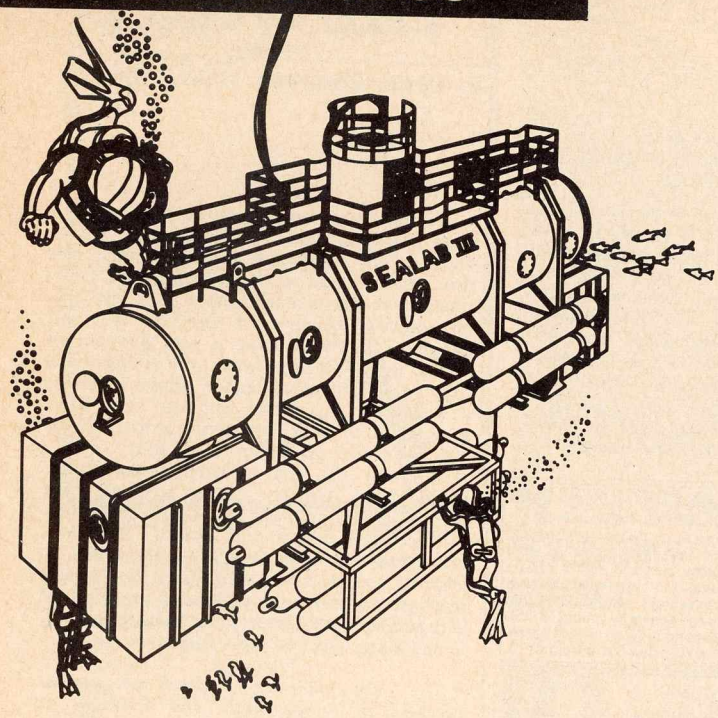
60-Day, 430 Feet MAN IN-THE-SEA

Project Slated for Spring



The third open-ocean phase of the Navy's Man-in-the Sea program is scheduled to commence late next spring. SEALAB III Aquanauts will be working over a two month-period 430 feet beneath the surface off the shores of San Clemente Island, Calif. The Aquanauts will carry out experimental salvage techniques, engage in oceanographic and marine biological research, and undergo a series of physiological and human performance tests. The open-ocean experiment is the most complex, advanced, and highly sophisticated ocean engineering experience attempted to date.

The objective of the SEALAB series of experiments is to gain knowledge and know-how pertinent to the adaptation of man to the deep sea environment at ambient pressure. The primary interest of the Navy and Department of Defense in Man-in-the-Sea is to provide a capability for rescue and salvage operations, maintenance of bottom-mounted equipment, utilization of the continental shelf for assistance in military operations, associated, for example, with mine defense and amphibious assaults. However, this program has vast secondary gains for the nation. The technology gained in Man-in-the-Sea will hasten and make possible the exploitation of the world's continental shelves for food, minerals, and recreation. The economic and scientific potential of the sea is perhaps as great or greater than that available on land surfaces.

By 1970, the U.S. Navy plans to have Diver-Aquanauts living in advanced sea habitations on the continental shelves for thirty days or more without coming to the surface. The depth capability of the Aquanauts will ultimately be extended from the average 600 foot depths of the shelves down to the unknown, as yet, physiological limits of man.

Five diving teams of eight men each, including civilian scientists as well as Navy divers, will occupy the underwater habitat alternately for 12-day periods during the scheduled 60-day experiment. Training of divers is now underway.

In addition to the complex and sophisticated system for physiological and psychological monitoring of the Aquanauts, a series of experiments will be undertaken to learn more about the sea, and how men may most efficiently work and live in the alien environment. Areas under study are: human performance; testing of specially designed underwater equipment; evaluation of salvage tools, equipment, and methods, physical oceanography experiments, topography and geology studies, and various marine studies.

The habitat for SEALAB III, a modification of the habitat used during the SEALAB II experiment, is a non-propelled submersible, constructed and shaped much like a submarine. It is designed as a pressure vessel to be lowered and emplaced on the ocean floor, and has positive stability on the surface, while submerging and while surfacing. Water ballast tanks are used to control positive and negative buoyance.

The living compartment of the habitat remains unchanged. Overall cylindrical in shape, it is 12 feet in diameter and 57 feet in length. However, two rooms, 8 feet high and 12 feet square are being constructed for attachment to the bottom or hull of the habitat, one forward and one aft of the craft. The after room will be used as a diving station. It houses diving lockers, diving gear, hot showers, and the

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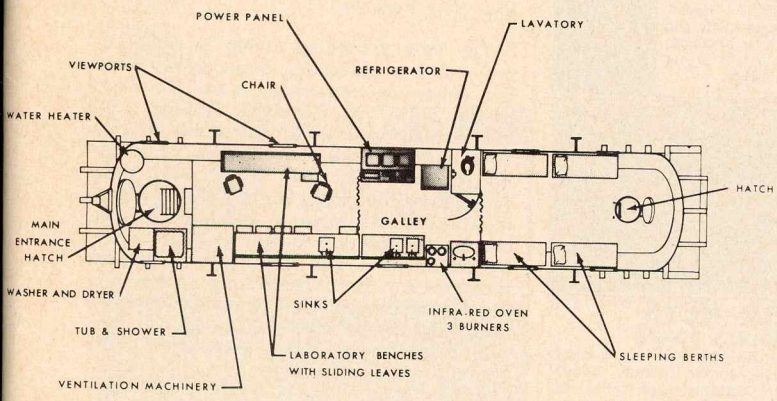

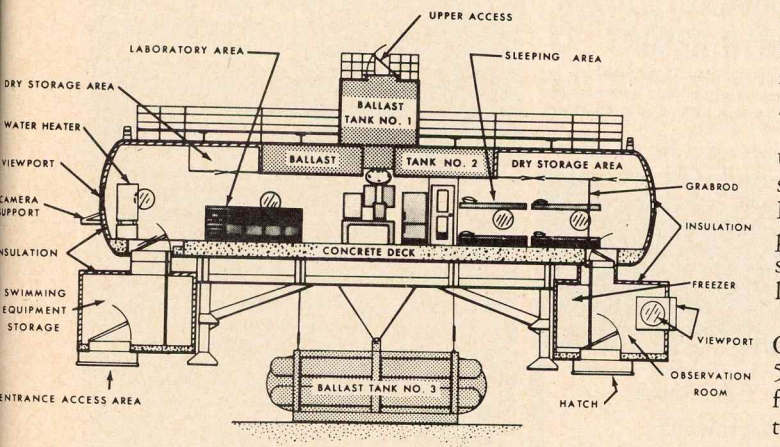

MAN-IN-THE-SEA

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open hatch for access to the sea. The forward room is planned for use as an observation and storage compartment. It is fitted with large portholes and a refrigeration-freezer unit. It has also an emergency exit hatch.

From the diving station compartment, the Aquanaut climbs a ladder through a hatch to the main living compartment. The living compartment can be sealed off from the diving station to reduce humidity. Modification of the habitat will also include the elimination of the need for manual adjustment of the breathing gas atmosphere through the installation of a sophisticated automatic helium-oxygen mixing system.

The living compartment is divided into a laboratory, galley, and bunkroom as one goes forward from the entryway. Eleven viewing ports are provided on the hull, each protected by a light outboard cover and a pressure inboard hinged cover. Electric power, fresh water, communications, TV links, and other life support needs are supplied from a surface vessel, which is stationed almost directly above the underwater habitat. Emergency life-sustaining supplies are maintained aboard the habitat.

The atmosphere in the living compartment is designed for 206 pounds per square inch absolute (corresponding to 430 feet of water). It contains approximately 92% helium, 6% nitrogen, and 2% oxygen. Replenishment gas is brought in by umbilical from the support ship or from external bottles stowed on the habitat. The atmosphere in the living compartment is charged on the surface and during lowering to the sea floor. The sixteen external breathing gas bottles will contain sufficient breathing gas for eight men to sustain life for fifteen days.

Carbon dioxide is removed from the atmosphere by use of a device known as a scrubber. It contains a chemical (lithium-hydroxide). Charcoal is used to remove odors, and both chemicals must be replaced as they are used. Electrical dehumidifiers control the humidity, and heat is supplied by convection heaters. The radiant heating system with thermostats maintain habitat temperature at about 92°F. Although this degree of heat would be excessive at the surface, it is required in the atmosphere of the habitat because body heat loss in helium atmosphere is greater.

The staging vessel to be used in support of the SEALAB operation will be a modified LSMR (Medium Rocket Landing Ship). This class of ship was originally designed to support landing operations, but its modification will enable the vessel to support all aspects of in place testing at the San Clemente Island Ocean Engineering Test Range.

In direct support of diving operations, the vessel will be outfitted with two deck decompression chambers — each designed to support four divers during the four day decompression period needed to return saturated divers from the pressures associated with the depth of 430 feet to normal atmospheric conditions. Much of the diving equipment to be installed during the modification will be used for this and future saturated diving operations. To transport the divers from the ship to the bottom habitat, a pressurized elevator system called a Personnel Transfer Capsule is being installed on the ship. The Personnel Transfer Capsule will mate with the deck decompression chambers so that at all times, whether topside or at the 430 foot operation depth in the ocean, the Aquanauts can be kept at pressures equivalent to the ambient ocean pressures.

The Navy's Man-in-the-Sea program began in 1958 with Project GENESIS. This project, a six year series of dry chamber, high-pressure experiments, led to the development of a new diving concept — saturated diving. This concept has given the Navy the potential for extended underwater experiments, and was also utilized by the American investigator Link and the French explorer Cousteau in their underwater living experiments.

The experiments which led to the development of the saturated diving concept proved that the length of time required for decompression was not invariably related to the length of the dive. For the first time it was demonstrated that the diver will absorb only a specific amount of gas at any given depth, this amount reaching its maximum amount after twenty-four hours of exposure under pressure. Thus after twenty-four hours in the ocean depths at pressure the diver's tissue and blood have reached equilibrium with the breathing gas, and he is fully saturated. Once fully saturated his decompression schedule remains constant regardless of how long he may stay beneath the surface, and this awakened scientists to the possibility of men living underwater for extended periods of time.

The Navy successfully tested its laboratory results in open-ocean experiments, projects SEALAB I and SEALAB II. These projects, in which Navy Aquanauts lived and worked in the ocean environment, conclusively demonstrated the possibilities of underwater living. SEALAB I was held during July and August of 1964 in the waters thirty miles southwest of Bermuda.